

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Sridhar, et al. **Docket:** 139151
Serial No.: 10/720,897 **Art Unit:** 2616
Filed: November 21, 2003 **Examiner:** Frank Duong
Title: Multicast Architecture for a Virtual Private Local Area network Service in a
Metro Ethernet Network

AMENDMENT

M/S Amendments
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In response to the Office Action (“Office Action”) dated June 26, 2007, please enter the following amendment:

Amendment to the Specification

Please replace paragraph [0018] with the following rewritten paragraph:

[0018] Another difference of system 10 as illustrated in Figure 1b versus Figure 1a is that Figure 1b is intended to illustrate the second overall routing configuration, that is, the configuration that applies to multicast communications (as opposed to unicast communications that are routed according to the illustration of Figure 1a). Specifically, in the preferred embodiment, central manager CM develops the second overall routing configuration based on various considerations as detailed below. As also detailed later, the second routing configuration preferably is maintained by communication of a different routing table from central manager CM to each of the PE nodes of the applicable network, where thereafter each such PE node routes multicast packets according to its respective table. Before detailing these aspects, note that Figure 1b illustrates an instance where the second overall routing configuration includes all of the LSPs of the first overall routing configuration shown in Figure 1a, with two exceptions. Specifically, in Figure 1b, LSP_{1A2} and LSP_{2A4}-LSP_{1A3} are not included in the second overall routing configuration due to issues relating to attributes of those LSPs as used in the first overall routing configuration of Figure 1a. For example, the excluded LSP_{1A2} and LSP_{2A4}-LSP_{1A3} may already be heavily loaded with unicast traffic. To further demonstrate this aspect, Figure 1b illustrates a circled “X” to depict that each of these LSPs are missing, and those X’s are labeled M_{1A2} to indicate the missing LSP_{1A2} and M_{2A4}-M_{1A3} to indicate the missing LSP_{2A4}-LSP_{1A3}, respectively. Thus, in Figure 1b, where a missing LSP exists, the PE nodes are prohibited from communicating multicast packets directly to one another, although those packets may be re-routed along any of the other LSPs illustrated in Figure 1b, as will be further demonstrated later.

Amendment to the Claims

1 (Currently Amended). A centralized node for coupling into a computer network along which network traffic flows between a plurality of nodes in a form of packets, programmed to perform the steps of:

identifying requirements of unicast packet traffic along the network, wherein the unicast packet traffic identifies a first traffic configuration along the network; and

constructing a second traffic configuration along the network, differing from the first traffic configuration, wherein the second traffic configuration is for routing multicast packet traffic along the network; and

communicating routing information representing at least a portion of the second traffic configuration to each node in the plurality of nodes, wherein each node in the plurality of nodes routes multicast packet traffic in response to the at least a portion of the second traffic configuration.

2 (Canceled). Please cancel claim 2.

3 (Currently Amended). The centralized node of claim 1 2:

wherein the step of constructing a second traffic configuration comprises constructing a Steiner tree along the network; and

wherein the at least a portion of the second traffic configuration communicated to each node corresponds to the connectivity of the respective node along the Steiner tree.

4 (Original). The centralized node of claim 3 wherein the at least a portion of the second traffic configuration indicates, to a receiving node that receives the at least a portion of the second traffic configuration, selected instances during which a received packet is to be communicated to multiple nodes in the plurality of nodes.

5 (Currently Amended). The centralized node of claim 1 ~~2~~ wherein the step of constructing a second traffic configuration comprises minimizing a cost function for all the nodes in the plurality of nodes.

6 (Original). The centralized node of claim 1 wherein the step of constructing a second traffic configuration comprises constructing a Steiner tree along the network.

7 (Currently Amended). ~~The centralized node of claim 6: A centralized node for coupling into a computer network along which network traffic flows between a plurality of nodes in a form of packets, programmed to perform the steps of:~~

~~identifying requirements of unicast packet traffic along the network, wherein the unicast packet traffic identifies a first traffic configuration along the network; and~~

~~constructing a second traffic configuration along the network, differing from the first traffic configuration, wherein the second traffic configuration is for routing multicast packet traffic along the network and wherein the step of constructing a second traffic configuration comprises constructing a Steiner tree along the network;~~

wherein for unicast communications each node in the plurality of nodes is bi-directionally coupled to each other node in the plurality of nodes by a pair of Label Switched Paths; and

wherein the step of constructing a Steiner tree comprises optimizing a cost that is selected from a greater of a cost associated with a first Label Switched Path in the pair of Label Switched Paths and a cost associated with a second Label Switched Path in the pair of Label Switched Paths.

8 (Original). The centralized node of claim 6 wherein the step of constructing a second traffic configuration further comprises supplementing the Steiner tree along the network by constructing one or more source based trees along the network.

9 (Currently Amended). The centralized node of claim 8: A centralized node for coupling into a computer network along which network traffic flows between a plurality of nodes in a form of packets, programmed to perform the steps of:

identifying requirements of unicast packet traffic along the network, wherein the unicast packet traffic identifies a first traffic configuration along the network; and
constructing a second traffic configuration along the network, differing from the first traffic configuration, wherein the second traffic configuration is for routing multicast packet traffic along the network and wherein the step of constructing a second traffic configuration comprises constructing a Steiner tree along the network and supplementing the Steiner tree along the network by constructing one or more source based trees along the network; and further programmed to perform the step of

communicating table routing information representing at least a portion of the second traffic configuration to each node in the plurality of nodes;

wherein each node in the plurality of nodes routes multicast packet traffic in response to the table routing information;

wherein the table routing information comprises Steiner tree entries that indicate a next hop for a received packet by associating a group to which a receiving node belongs with a destination node in the plurality of nodes; and

wherein the table routing information further comprises source based tree entries that indicate a next hop for a received packet by associating a group to which a receiving node belongs and an ingress node in the plurality of nodes with a destination node in the plurality of nodes.

10 (Original). The centralized node of claim 9 wherein each node in the plurality of nodes is programmed to perform a step of identifying an association between the respective node when it is operating as an ingress node and one or more MAC addresses external from the network.

11 (Original). The centralized node of claim 9 wherein the table routing information indicates, to a receiving node that receives the table routing information, selected instances during which a received packet is to be communicated to multiple nodes in the plurality of nodes.

12 (Original). The centralized node of claim 11 wherein the network comprises a Metro Ethernet network.

13 (Original). The centralized node of claim 12 wherein the plurality of nodes comprises a virtual private local area network service.

14 (Original). The centralized node of claim 1:

wherein each node in the plurality of nodes comprises a Provider Edge node; and

wherein for unicast communications each Provider Edge node in the plurality of nodes is coupled to communicate directly with each other Provider Edge node in the plurality of nodes.

15 (Original). The centralized node of claim 1 wherein the centralized node is one node in the plurality of nodes.

16 (Original). The centralized node of claim 1:

wherein the plurality of nodes comprises more than one group of nodes;

wherein the step of constructing a second traffic configuration along the network comprises constructing the second traffic configuration for a first group of nodes in the more than one group of nodes; and

wherein the centralized node is further programmed to perform a step of constructing a different respective second traffic configuration along the network for each group in the more than one group of nodes.

17 (Original). The centralized node of claim 16 wherein the step of constructing a different respective second traffic configuration comprises, for each different respective second traffic configuration:

constructing a Steiner tree along the network; and

supplementing the Steiner tree along the network by constructing one or more source based trees along the network.

18 (Currently Amended). A method of operating a computer network along which network traffic flows between a plurality of nodes in a form of packets, comprising:

communicating unicast packet traffic along the network according to a first traffic configuration along the network; and

communicating multicast packet traffic along the network according to a second traffic configuration along the network, wherein the second traffic configuration differs from the first traffic configuration; and

communicating routing information representing at least a portion of the second traffic configuration to each node in the plurality of nodes, wherein each node in the plurality of nodes routes multicast packet traffic in response to the at least a portion of the second traffic configuration.

19 (Original). The method of claim 18 and further comprising constructing the second traffic configuration by the steps of:

constructing a Steiner tree along the network; and

supplementing the Steiner tree along the network by constructing one or more source based trees along the network.

20 (Currently Amended). A node for coupling into a computer network along which network traffic flows between a plurality of nodes in a form of packets, wherein the plurality of nodes includes the node for coupling, the node for coupling programmed to perform the steps of:

communicating unicast packet traffic along the network according to a first traffic configuration along the network; and

communicating multicast packet traffic along the network according to a second traffic configuration along the network, wherein the second traffic configuration differs from the first traffic configuration; and

receiving, along the network, table routing information representing at least a portion of the second traffic configuration, wherein the table routing information is responsive to at least a portion of a Steiner tree along the network.

21 (Canceled). Please cancel claim 21.

22 (Currently Amended). The node for coupling of claim 20 ~~24~~ wherein the table routing information is further responsive to one or more source based trees along the network.

REMARKS

Claims 1, 3 through 20 and 22 remain in this application. Claims 2 and 21 have been canceled. Claims 1, 3, 5, 7, 9, 18, 20 and 22 have been amended.

Objection to the Drawings

The Office Action objected to Figure 1a stating that it illustrates only that which is old and that it should be designated by a legend such as --Prior Art--. Applicants respectfully disagree. The specification states at page 5, paragraph 10 that "Figure 1a illustrates a network system according to the preferred embodiment and with respect to the flow of unicast traffic." In addition, the specification states at pages 7-8 in paragraph 16, "Figure 1b again illustrates system 10 of Figure 1a, but the illustration of Figure 1b is intended to depict issues directed to certain inventive aspects and pertain to multicast communications in system 10. Further, as appreciated through the remainder of this document, these aspects preferably are combined with the illustration of Figure 1a whereby system 10 per Figure 1a routes unicast communications in a first overall routing configuration such as in a point-to-point manner in a fully-meshed configuration, whereas system 10 per Figure 1b routes multicast communications in a second overall routing configuration that differs at least in part from the first overall configuration, and for sake of distinction the multicast LSPs are shown with illustrated with dashed arrows." From these descriptions, it is clear that Figure 1b illustrates part of at least one embodiment of the present invention as stated in the claims and thus, does not illustrate only that which is old.

Objection to the Specification

Correction to the typographical errors in paragraph 18 on page 9 are corrected above.

Claim Rejections under 35 U.S.C. § 102

The Office Action rejected claims 1, 6, 8 and 14-20 under 35 U.S.C. 102(e) as being anticipated U.S. Patent Application Publication 2004/0037279 to Zelig et al. (the "Zelig reference"). However, the Office Action indicated that Claims 2-5, 7, 9-13 and 21-22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in

independent form including all of the limitations of the base claim and any intervening claims. The above claims have been amended to include the limitations indicated as allowable.

CONCLUSION

For the above reasons, the foregoing amendment places the Application in condition for allowance. Therefore, it is respectfully requested that the rejection of the claims be withdrawn and full allowance granted. Should the Examiner have any further comments or suggestions, please contact Jessica Smith at (972) 240-5324.

Respectfully submitted,
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Dated: October 26, 2007 /Jessica Smith/

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